Texas Electric Transportation Resources Alliance

Leading Texas Toward an Electric Transportation Future

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The materials, positions and questions are the work of TxETRA staff and collaborators. They do not represent the formal positions of member companies. They are based on conversations in our working group.
What is TxETRA?

**Texas Transportation Resource Alliance**

We are a non-profit group for utilities, manufacturers, charging companies and environmentalists.

We are developing policy needed to electrify the Texas transportation system.
The Big Questions

- How and where will we plug in EVs?
- How do we keep EVs from overloading the grid?
- How do we deal with geographic and economic equity concerns?
- What consumer protections should be put in place?
- How do we assure the batteries are reused or recycled?
<table>
<thead>
<tr>
<th>Why are Electric Vehicles Transforming the Transportation Market so Rapidly?</th>
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<tbody>
<tr>
<td>Reduces ozone levels</td>
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<tr>
<td>Climate commitments</td>
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<tr>
<td>Lower and more stable fuel price</td>
</tr>
<tr>
<td>Lower maintenance cost</td>
</tr>
<tr>
<td>EVs provide grid stability</td>
</tr>
<tr>
<td>Promising new industries for emerging countries</td>
</tr>
<tr>
<td>Can be powered with renewables &amp; storage</td>
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</tbody>
</table>
A Massive Shift in Vehicle Investments is Occurring

$435B  Total Global Investment
$63.6B  Investments Targeted for USA
61  Companies

In Texas we might expect this transition to be driven by the market by some incentives.

https://www.atlasevhub.com/materials/private-investment/ 9/30/20
Over 200 EV Models Will Be On The Road by 2022

Including 10 Pick-Up Trucks

https://www.ahssinsights.org/news/battery-electric-vehicles-boom-or-bust-for-ahss/
EVs Offer Big Savings Over Traditional Gas-Powered Cars

POWER STRUGGLE:
ELECTRIC VS. GAS MAINTENANCE COSTS

GAS-ONLY
PLUG-IN HYBRID
ALL-ELECTRIC PLUG-IN (EV)

$1,411
$1,064
$577

$4,417
$2,623
$1,967

$12,285
$5,915
$6,276

FIRST 50K MILES
FIRST 100K MILES
LIFETIME (200K MILES)

Source: Consumer Reports’ 2019 and 2020 reliability surveys.

https://www.consumerreports.org/hybrids-evs/evs-offer-big-savings-over-traditional-gas-powered-cars/
Innovative Technology is Driving the Battery Cost Decline

Battery Density Has Increased 6-7% Per Year

Charging Ahead
The cost of lithium-ion batteries continue to fall each year

- real
- projected

Source: BloombergNEF
Note: 2019 USD prices

Electric dreams
Manufacturing capacity
Gigawatt-hours per year

Panasonic* (Japan)
CATL (China)
BYD (China)
LG Chem (South Korea)
Samsung SDI (South Korea)

Battery cost
Worldwide, $/kWh

Battery energy density
Whatt-hours per litre

Sources: Cairn ERA; US Department of Energy

*Includes Tesla gigafactory


www.economist.com
Transition to EVs Could Occur in 15 Years or Fewer

Horses & Buggies → Automobiles
Radios → TVs
Landlines → Mobile Phones
Desktops → Tablets
No Renewables → Renewable Energy
If EVs transform the market as fast as SUVs have, then we predict by 2030, EVs will be 41.6% percent of light duty vehicles and 15% of fleet vehicle sales.
## Truckers Will Be The Biggest Users of EVs

<table>
<thead>
<tr>
<th>Type</th>
<th>Fueling Cost</th>
<th>200 Mile Fuel Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel 8 MPG</td>
<td>$4/Gallon</td>
<td>$100</td>
</tr>
<tr>
<td>Electric</td>
<td>1.6 kWh/Mile</td>
<td>$0.12 kWh</td>
</tr>
</tbody>
</table>

# Charging Patterns

<table>
<thead>
<tr>
<th>Category</th>
<th>Characteristics</th>
<th>Level</th>
<th>Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Family Residential</td>
<td>&gt;80% of EV owners</td>
<td>Level 1 &amp; 2</td>
<td>120 V AC</td>
</tr>
<tr>
<td></td>
<td>&gt;60% of homeowners</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Higher income on average</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multifamily Residential</td>
<td>&lt;20% of EV owners</td>
<td>Level 2</td>
<td>200-240 V AC</td>
</tr>
<tr>
<td></td>
<td>&lt;15% homeowners</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lower income on average</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workplace</td>
<td>&gt;85% workers drive to work</td>
<td>Level 2</td>
<td>200-240 V AC</td>
</tr>
<tr>
<td></td>
<td>Suburban vs. urban</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Commitment to sustainability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban Public DCFC</td>
<td>Commuters, consumers</td>
<td>DC fast charging</td>
<td>400 V – 1000 V DC</td>
</tr>
<tr>
<td></td>
<td>Co-location opportunities</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Overlap with inter-city</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inter-city DCFC</td>
<td>Inter-city travelers – fun/work</td>
<td>DC fast charging</td>
<td>400 V – 1000 V DC</td>
</tr>
<tr>
<td></td>
<td>Inter-city freight</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Also co-location opportunities</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Assumed Normalized Average Hourly Charging Pattern for EVs by Type

Most cars were assumed to charge overnight so that they would be fully charged before 5am.

Trucks and buses were assumed to charge around noon and again overnight.

Renewables Match EV Charging Cycles Almost Perfectly

Solar and Wind Production 2018
You Can Eliminate Peak Overloading By Encouraging EVs To Charge Off Peak Through Time Of Use Rates and Demand Controls

A recent UT study showed that 100% of plug in vehicles could be charged in Texas.
How Do We Assure Charging Occurs At The Best Time To Reduce Pollution?

Smart chargers can delay or reduce charging on peak.

Most EVs have charging controls.

2011 Volt Controls

- Charge Start: 120V 6:20 AM, 240V 6:45 AM
- Charge Complete: 120V 7:00 AM, 240V 7:00 AM
The Impact of Direct Current Fast Chargers (DCFCs)

Fast chargers will provide charging in the 20 minute to 2-hour time frame for vehicles.

A fast charging station for delivery vans with six 50 kW chargers would have a peak demand of 300 kW.

A large heavy-duty EV charging truck stop can easily be 1.5 MW.
Fast Charging Impacts on T&D
"Location, Location, Location"

Texas needs to develop a border-to-border charging network.

This map shows locations about 50 miles apart where T&D is adequate for HD charging stations.
U of H researchers say replacing at least 35 percent of Houston's gasoline cars and diesel trucks with electric vehicles by 2040 will reduce pollution and improve air quality by 50 percent. ...Jun 11, 2019

How to Ensure That Access to Charging Facilities Do Not Create a New "Digital Divide"

Without regulatory action, charging facilities in these areas will unlikely be able to develop.

- Multi-family apartment complexes
- Street-side charging units
- Public facilities in low-income communities
- Charging along interstates and interregional roads
- Charging in small rural towns
Ongoing Policy Discussions

- PUC docket on EVs
- TCEQ funding for EVs and chargers and EV emissions impact study
- DMV study on fees
- Tx Dept of Licensing and Regulation sunset review
Preliminary Thoughts For An Omnibus Bill

**PUC**

- Consumer protections
  - Charging should be a universally available service-like:
    - farm to market roads,
    - rural electric service by coops
    - universal phone

- Other issues TBD after docket is discussed

**TDMV**

- Road use fees

**TxDOT**

- Signs for charging
- Rest stop charging
Preliminary Thoughts For An Omnibus Bill

TERP
- Lift cap on number of light duty vehicles
- Allow incentive to be paid to dealer so the incentive can be paid at closing

Funnel for federal and state charging stations funds

Battery recycling standards

TCEQ

TDLR

Public charging inspections
Consumer protections
Now is the Time to Prepare for the EV Boom

We have an opportunity to set policy ahead of the demand

Other countries and states have gone before us, so we can use the best practices they have developed

If we plan now, we can accelerate through the boom